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The diagram illustrates the step-by-step construction of a Huffman tree for the sentence "A Huffman tree is a binary tree where each internal node has two children and each leaf node contains a character and its frequency. The tree is built by repeatedly merging the two smallest trees until only one tree remains. The final tree is then used to encode the characters into binary strings.

**Step 1:** Initial character frequencies are listed. The two smallest frequencies are 1 (A) and 1 (H), which are merged into a new internal node with frequency 2.

**Step 2:** The next two smallest frequencies are 2 (the merged node from Step 1) and 1 (T), which are merged into a new internal node with frequency 3.

**Step 3:** The next two smallest frequencies are 3 (the merged node from Step 2) and 1 (I), which are merged into a new internal node with frequency 4.

**Step 4:** The next two smallest frequencies are 4 (the merged node from Step 3) and 1 (S), which are merged into a new internal node with frequency 5.

**Step 5:** The next two smallest frequencies are 5 (the merged node from Step 4) and 1 (B), which are merged into a new internal node with frequency 6.

**Step 6:** The next two smallest frequencies are 6 (the merged node from Step 5) and 1 (N), which are merged into a new internal node with frequency 7.

**Step 7:** The next two smallest frequencies are 7 (the merged node from Step 6) and 1 (D), which are merged into a new internal node with frequency 8.

**Step 8:** The next two smallest frequencies are 8 (the merged node from Step 7) and 1 (R), which are merged into a new internal node with frequency 9.

**Step 9:** The next two smallest frequencies are 9 (the merged node from Step 8) and 1 (E), which are merged into a new internal node with frequency 10.

**Step 10:** The next two smallest frequencies are 10 (the merged node from Step 9) and 1 (O), which are merged into a new internal node with frequency 11.

**Step 11:** The next two smallest frequencies are 11 (the merged node from Step 10) and 1 (P), which are merged into a new internal node with frequency 12.

**Step 12:** The next two smallest frequencies are 12 (the merged node from Step 11) and 1 (Q), which are merged into a new internal node with frequency 13.

**Step 13:** The next two smallest frequencies are 13 (the merged node from Step 12) and 1 (U), which are merged into a new internal node with frequency 14.

**Step 14:** The next two smallest frequencies are 14 (the merged node from Step 13) and 1 (V), which are merged into a new internal node with frequency 15.

**Step 15:** The next two smallest frequencies are 15 (the merged node from Step 14) and 1 (W), which are merged into a new internal node with frequency 16.

**Step 16:** The next two smallest frequencies are 16 (the merged node from Step 15) and 1 (X), which are merged into a new internal node with frequency 17.

**Step 17:** The next two smallest frequencies are 17 (the merged node from Step 16) and 1 (Y), which are merged into a new internal node with frequency 18.

**Step 18:** The next two smallest frequencies are 18 (the merged node from Step 17) and 1 (Z), which are merged into a new internal node with frequency 19.

**Step 19:** The next two smallest frequencies are 19 (the merged node from Step 18) and 1 (space), which are merged into a new internal node with frequency 20.

**Step 20:** The final tree is constructed, with the root node having a frequency of 20. The tree is then used to encode the characters into binary strings.

**Encoding:** The characters are encoded into binary strings using the Huffman tree. The encoding process involves traversing the tree from the root to the leaf node containing the character, recording the path (left = 0, right = 1). The resulting binary strings are then concatenated to form the final encoded message.

**Decoding:** The encoded message is decoded by traversing the Huffman tree from the root to the leaf node, using the binary string to determine the path. The characters are then extracted from the leaf nodes to reconstruct the original message.

**STEP 3**

1  
2  
3

**STEP 4**

1  
2  
3

**STEP 5**

1 OK  
2 YES/NO  
①  
②  
③  
④  
⑤  
3



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